

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Ryan et al.
Docket: AMDA.389DIV1
Title: Reticle Sorter

CERTIFICATE UNDER 37 CFR 1.10

'Express Mail' mailing label number: EL096878177US

Date of Deposit: August 26, 1999

I hereby certify that this paper or fee is being deposited with the United States Postal Service 'Express Mail Post Office To Addressee' service under 37 CFR 1.10 and is addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

By: Lynda K. Jaskowiak
Name: Lynda K. Jaskowiak

BOX PATENT APPLICATION
Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

We are transmitting herewith the attached:

- ☒ Transmittal sheet containing Certificate under 37 CFR 1.10.
- ☒ Request for filing a Divisional Application Under 37 C.F.R. § 1.60
- ☒ The copy of the prior application is as follows: 8 pages of specification, 18 claims, 1 page of abstract, 4 sheets of drawings, and 4 pages of oath and declaration.
- ☒ **PAYMENT OF THE FILING FEE IS BEING CHARGED TO DEPOSIT ACCOUNT NO. 01-0365 (TT2354-DIV).**
- ☒ Two return postcards.

Please consider this a PETITION FOR EXTENSION OF TIME for a sufficient number of months to enter these papers, if appropriate, and charge any required fees to the Deposit Account No. 01-0365.

CRAWFORD PLLC
333 Washington Avenue North, Suite 5000
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(612) 349-2700

By: Robert J. Crawford
Name: Robert J. Crawford
Reg. No.: 32,122

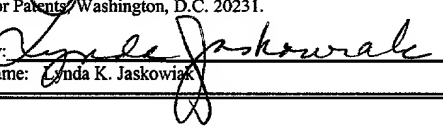
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

DOCKET NUMBER	ANTICIPATED CLASSIFICATION OF THIS APPLICATION:	PRIOR APPLICATION Serial No. 09/107,111		
	CLASS	SUBCLASS	EXAMINER	ART UNIT
AMDA.389DIV1			J. Murphy	2812

CERTIFICATE UNDER 37 CFR 1.10:

"Express Mail" mailing label number: EL096878177US
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By: 
Name: Linda K. Jaskowski

DIVISIONAL APPLICATION UNDER 37 C.F.R. § 1.60

Assistant Commissioner for Patents
Washington, DC 20231

Dear Sir:

This is a request for filing a divisional application under 37 CFR § 1.60 of Serial No. 09/107,111, filed on June 30, 1998 entitled RETICLE SORTER by the following inventor(s):

Full Name Of Inventor	Family Name RYAN	First Given Name PATRICK	Second Given Name J.
Residence & Citizenship	City AUSTIN	State or Foreign Country TEXAS	Country of Citizenship USA
Post Office Address	Post Office Address 3148 DACY LANE	City AUSTIN	State & Zip Code/Country TEXAS 78640/USA
Full Name Of Inventor	Family Name CONBOY	First Given Name MICHAEL	Second Given Name R.
Residence & Citizenship	City AUSTIN	State or Foreign Country TEXAS	Country of Citizenship USA
Post Office Address	Post Office Address 3102 SUNLAND DRIVE	City AUSTIN	State & Zip Code/Country TEXAS 78748/USA
Full Name Of Inventor	Family Name HOVESTOL	First Given Name STEPHEN	Second Given Name P.
Residence & Citizenship	City AUSTIN	State or Foreign Country TEXAS	Country of Citizenship USA
Post Office Address	Post Office Address 3128 SILKGRASS BEND	City AUSTIN	State & Zip Code/Country TEXAS 78748/USA

1. ☒ Enclosed is a true and correct copy of the prior application; including the specification, claims, drawings, oath or declaration showing the applicant's signature, and any amendments referred to in the oath or declaration filed to complete the prior application. (It is noted that no amendments referred to in the oath or declaration filed to complete the prior application introduced new matter therein.) The copy of the prior application is as follows: 8 pages of specification, 18 claims, 1 pages of abstract, 4 sheets of drawings, and 4 pages of oath or declaration.
2. ☒ Cancel in this application original claims 13-18 of the prior application before calculating the filing fee. (At least one original independent claim must be retained for filing purposes.)
3. ☒ The filing fee is calculated below:

CLAIMS AS FILED

NUMBER FILED	NUMBER EXTRA		RATE	FEE
TOTAL CLAIMS: 12 -20	0	X	\$18.00	\$0.00
INDEPENDENT CLAIMS -3	0	X	\$78.00	\$0.00
			BASIC FILING FEE:	\$760.00
			TOTAL FILING FEE:	\$760.00

- ☐ A Verified Statement that this filing is by a small entity is already filed in the prior application.
- ☐ A Verified Statement that this filing is by a small entity is attached.
- ☒ Payment of fees:
 - ☐ Attached is a check in the amount of \$.
 - ☒ Please charge Deposit Account No. 01-0365 (TT2354-DIV).
6. ☒ Amend the specification by inserting before the first line the sentence:

"This is a Divisional of Application Serial No. 09/107,111, filed June 30, 1998, which application(s) are incorporated herein by reference."
7. ☐ A set of formal drawings (____ sheets) is enclosed.
8. ☒ Priority of application Serial No. 09/107,111, filed on June 30, 1998, is claimed under 35 U.S.C. 120.
 - ☐ The certified copy has been filed in prior application Serial No. _____, filed _____.
9. ☒ The prior application is assigned of record to Advanced Micro Devices, Inc.

10. ☒ The Power of Attorney in the prior application is to:

Merchant, Gould, Smith, Edell, Welter & Schmidt
3100 Norwest Center
90 South Seventh Street
Minneapolis, MN 55402-4131

11. ☐ A preliminary amendment is enclosed. (Claims added by this amendment have been properly numbered consecutively beginning with the number next following the highest numbered original claim in the prior application.)

☐ Fee for excess claims is attached.

12. ☐ A petition and fee has been filed to extend the term in the prior application until _____. A copy of the petition for extension of time in the prior application is attached.

13. ☐ The inventor(s) in this application are less than those named in the prior application and it is requested that the following inventors identified above for the prior application be deleted:

14. ☐ Also Enclosed:

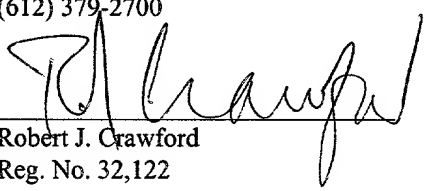
☒ Address all future communications to the **Attention of Robert J. Crawford** (may only be completed by attorney or agent of record) at the address below.

☒ Two return postcards are enclosed.

Respectfully submitted,

CRAWFORD PLLC
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Date: 8/26, 1999


Robert J. Crawford
Reg. No. 32,122

AMD Reference Number: TT2354
M&G Reference Number: 11729.196US01

RETICLE SORTER

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RETICLE SORTER

Field of the Invention

The present invention generally relates to the semiconductor fabrication process and, more particularly, to a reticle sorter and a semiconductor fabrication facility employing one or more reticle sorters.

Background of the Invention

Semiconductor manufacturers compete in a highly competitive and capital-intensive industry. A state-of-the-art semiconductor fabrication facility can cost \$1 billion or more and include hundreds of different fabrication tools including, for example, material stockers, chemical vapor deposition (CVD) systems, photolithography systems, chemical-mechanical planarization systems, etc. On any given day, a number of different batches of semiconductor wafers can run through a fabrication facility. To recover the capitalization costs and remain competitive, semiconductor manufacturers continually seek to improve semiconductor throughput and yield.

Manufacturers pay particular attention the photolithography process, a process which occupies a substantial amount of floor space and is performed on a given wafer a number of different times throughout the fabrication process. The photolithography process typically involves applying a photoresist layer (e.g., SiO_2) over the surface of a semiconductor wafer using a coating machine or coater. The wafer then moves to an exposure tool, such as a photolithography stepper, which exposes the photoresist layer to a patterned light source. The light source is typically patterned using a mask or reticle (hereinafter reticle). The reticle typically contains clear and opaque features which generally define the pattern to be created in the photoresist layer. The exposed photoresist is then developed and regions of the photoresist are dissolved such that the pattern is transferred to the photoresist layer. The exposed regions of the underlying

semiconductor wafer layer are then processed by, for example, etching the exposed wafer layer, depositing a material on the exposed wafer layer, or doping the exposed wafer layer.

For a given wafer, the photolithography process may be used a number of times
5 as layers are formed over layers to form the ultimate semiconductor device structure. To perform the various photolithography processes, a typical plant employs upwards of 10-20 different photolithography steppers and can use thousands of different reticles. Given the substantial use of photolithography in the semiconductor fabrication process, manufacturers find any increase in the throughput of photolithography systems to be
10 highly desirable.

Summary of the Invention

The present invention provides a reticle sorter and a semiconductor fabrication facility employing one or more reticle sorters. The reticle sorter(s) generally lies
15 between a reticle storage system and a group or cell of one or more photolithography exposure tools and is configured for sorting reticles in one or more cassettes. The use of the reticle sorter provides sorting functionality apart from the reticle storage system and typically closer to the cell of photolithography exposure tool(s) with which it is associated. This can, for example, significantly increase the throughput of
20 semiconductor wafers through the associated exposure tools as well as in the semiconductor fabrication plant as a whole.

In accordance with one embodiment of the invention, there is provided a reticle sorter coupled between a reticle storage system and one or more photolithography exposure tools. The reticle sorter includes one or more bays each capable of holding a
25 cassette having slots for reticles and a sorting system capable of retrieving the reticles from and inserting the reticles into the slots in order to sort the reticles within the cassettes. The reticle sorter may further include an inspection system, coupled between the one or more bays and an inport port, for inspecting a characteristic of each reticle. The inspection system may, for example, provide a visual display of each reticle as it is

loaded into the reticle sorter, inspect each reticle for dust and/or inspect for flaws in the reticle pattern.

The above summary of the present invention is not intended to describe each illustrated embodiment or every implementation of the present invention. The Figures and the detailed description which follow more particularly exemplify these embodiments.

Brief Description of the Drawings

The invention may be more completely understood in consideration of the following detailed description of various embodiments of the invention in connection with the accompanying drawings, in which:

Figure 1 schematically illustrates a conventional semiconductor fabrication facility;

Figure 2 illustrates an exemplary semiconductor fabrication facility in accordance with one embodiment of the invention;

Figures 3A - 3C illustrate components of an exemplary reticle sorter in accordance with another embodiment of the invention; and

Figure 4 illustrates a process flow for a reticle sorter in accordance with yet another embodiment of the invention.

While the invention is amenable to various modifications and alternative forms, specifics thereof have been shown by way of example in the drawings and will be described in detail. It should be understood, however, that the intention is not to limit the invention to the particular embodiments described. On the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the invention as defined by the appended claims.

Detailed Description

Figure 1 schematically illustrates, albeit in a relatively simple form, a conventional semiconductor fabrication facility 100. The fabrication plant 100 typically includes multiple fabrication areas or bays 110 interconnected by a path 120, such as a

conveyor belt. Each bay 110 generally includes the requisite processing tools to process semiconductor wafers for a particular purpose, such as photolithography, chemical-mechanical polishing, or chemical vapor deposition, for example. To handle the various photolithography processes, the conventional plant 100 further includes multiple photolithography exposure tools such as steppers 112 and a single reticle storage system 130. The photolithography steppers 112 generally use a number of different reticles for fabricating layers of semiconductor wafers. The reticle storage system 130 generally handles storage and sorting of reticles within cassettes. The reticle storage system 130 typically includes a buffer or queue for storing reticles, one or more inspecting systems for inspecting various characteristics of the reticles, and a sorting system for rearranging the various reticles within various cassettes as dictated by the fabrication process. In many fabrication facilities, the buffer of the reticle storage system 130 may have enough room to store up to 1500 reticles or 300 cassettes. The inspection systems may include systems for detecting dust particles in the reticle, identifying flaws in the reticle pattern, the visual inspection system and so forth as well known in the art. While not shown, the semiconductor fabrication plant 100, including the bays 110, photolithography steppers 112, reticle storage system 130 and the interconnecting path 120, typically operates under control of a host system, typically a distribution computer system operating under a factory management program, such as WorkStream Open™ sold by Consilium, Inc.

Figure 2 illustrates an exemplary fabrication facility having a reticle storage system as well as one or more reticle sorters in accordance with one embodiment of the invention. The exemplary fabrication facility 200 generally includes a reticle storage system 210, a plurality of photolithography exposure tools such as steppers 220, and one or more reticle sorters 230 each associated with a group of one or more of the photolithography steppers 220. The invention is however not limited to the use of photolithography steppers, but extends to cover any type of exposure tool which uses a reticle to transfer a pattern to a wafer. While not shown, it should be appreciated that each of the reticle storage system 210, reticle sorters 230, and photolithography steppers 220 are communicatively coupled to a host system (e.g., Workstream) and can operate under instructions from the host system.

The reticle storage system 210 typically provides the same functionality and may, if desired, be the same system as the conventional reticle storage system 130 discussed above. For example, the reticle storage system 210 may include a buffer for storing reticles and cassettes, inspection systems for inspecting various characteristics of the reticles, and a sorting system capable of rearranging the reticles within the cassettes as dictated by the host system.

The exemplary fabrication facility 200, as noted above, further includes one or more reticle sorters 230 each interfacing with a group of one or more photolithography steppers 220. The illustrated embodiment includes four reticle sorters 230 each of which handle the reticle sorting for an associated cell of photolithography steppers 220. Exemplary cell groupings A, B, C, and D are shown in Figure 2. While only four reticle sorters 230 are illustrated in the exemplary embodiment, it should be appreciated that as few as one and, more often, many more than four are used within a semiconductor fabrication facility. Typically, the number of reticle sorters in a fabrication facility is selected in consideration of the number of reticles used in the fabrication process as well as the number of photolithography steppers in the facility. For many applications, one reticle sorter for every 2 to 8 photolithography steppers would be suitable.

Reticle sorters generally provide efficient systems for sorting reticles within cassettes for associated cells of photolithography steppers 230. The invention is not limited to any particular physical arrangement of the reticle sorter, provided the reticle sorter is capable of holding one or more cassettes and accessing reticles within the cassettes for sorting the reticles into a desired order. By way of example and not of limitation, Figures 3A and 3B illustrate the physical features of an exemplary reticle sorter. The exemplary reticle sorter 300 generally includes one or more docking locations 310 each capable of holding a cassette 320 having slots for reticles 324 and an arm 330 capable of retrieving the reticles 324 from and inserting the reticles 324 into the slots in order to sort the reticles 324 within each cassette 320. Typically, the arm 330 operates under control of a controller 340 coupled to the arm 330 for controlling the sorting of the reticles 324 according to commands from a host system (not shown). The host system typically commands the arm 330 to sort the reticles within the cassettes in a

manner which optimizes the use of the reticles when the cassettes 320 are dispersed to the cell of photolithography steppers with which the reticle sorter 300 is associated. The arm 330, similar to those used in conventional reticle storage systems, typically includes claws for grasping the plastic bevel edges of the reticles 324.

5 In the illustrated embodiment, the reticle sorter 300 further includes a reticle docking location 350, typically centrally located, on which a reticle 324 may be disposed. This provides a temporary holding place for a reticle 324 in the event reticles must be sorted and each cassette 320 within the reticle sorter 300 is full. In operation, the arm 330 accesses the reticles within a cassette, extracts a particular reticle and places
10 the reticle in an open slot of a different or the same cassette. To open a desired slot within a cassette 320, the reticle 324 within the desired slot may be extracted and removed to another open slot or placed on the storage location 350.

 The reticle sorter 300 typically further includes input and output ports 360 and 370, respectively, each of which are coupled to a cassette carrying path (not shown) for
15 conveying the cassettes to and from the associated cell of photolithography stepper(s) as is well known in the art. Between the input port 360 and the docking area 390, one or more inspections systems 380 may be provided for inspecting characteristics of the reticles 324 as they enter the docking area 390 of the reticle sorter 300. The type and number of inspection systems employed can vary. For example, the reticle sorter 300
20 may included a video camera and display device for displaying an image of each reticle for visual inspection. Additional inspection systems, such as systems for dust particle monitoring and reticle pattern flaw detection, may be provided if desired. The video inspection system is simple and relatively inexpensive to provide. Inexpensive and/or frequently necessary inspections, such as a visual inspection, may advantageously be
25 moved to the reticle sorters thereby preventing frequent trips to a reticle storage system. Less frequent and/or more expensive inspections, such as dust and pattern flaw detection, may remain at the reticle storage system. In this manner, reticle inspection (in addition to sorting) may be distributed throughout the semiconductor fabrication facility and wafer throughput may be increased.

Figure 4 illustrates an exemplary flow process performed by a reticle sorter in accordance with one embodiment of the invention. As indicated at block 402, the reticle sorter first receives one or more cassettes for sorting. Typically, a host system, which tracks each of the reticle-storing cassettes, identifies a particular one or more cassettes for resorting and requests the cassettes to be moved to the reticle sorter. The selected cassettes may, for example, come from the reticle storage system and/or the cell of stepper(s) associated with the reticle sorter. This step may further include identifying the reticles within the cassettes in order to ensure that the proper reticles are being used. Typically, reticle identification is performed by reading a unique identifier of the cassettes and/or reticles using a scanner as is well known in the art. At this point, various characteristics of the reticles may optionally be inspected, as indicated at block 404. The inspection process may be performed serially with reticle identification in order to avoid multiple accessing of the reticle within the cassette.

Following inspection, if any, reticles within the cassette(s) are sorted, as indicated at block 406. Typically, this includes loading each cassette into a docking location using, for example, a robotic arm or an assembly track with the cassette being carried along the track and moved into a docking location which rotates to a pickup point. Once loaded, the reticles within the cassette(s) may be sorted. Typically, this includes, opening one or more cassettes, retrieving a particular reticle from an open cassette and placing the selected reticle in an open slot of the same or another cassette. If the desired slot for the selected reticle is not open, typically the desired slot is opened by removing the reticle from the desired slot and placing it in another open slot or on a reticle storage location. As noted above, the sorting of the reticle system is typically performed under control of a controller which receives instructions received from a host system.

The reticle sorter then dispatches the cassette(s) to the associated exposure tools (e.g., photolithography steppers), as indicated at block 408. Typically, this includes moving each cassette from its respective docking bay to the output port of the sorter using, for example, a moving means such as a robotic arm or a conveyor belt. Under control the host system, the cassettes are then dispatched to the appropriate

photolithography stepper. After dispatching the cassettes, the reticle sorter then waits to receive another group of one or more cassettes for sorting, as indicated at block 402. In this manner, sorting of reticles is distributed throughout the fabrication facilities rather than isolated at the central storage unit. The need for reticle sorting by the reticle storage system is also reduced. The host system, however, typically periodically moves cassettes to the reticle storage system for storage and/or to undergo inspection beyond inspection applied at the reticle sorters.

By employing reticle sorters as discussed above, wafer throughput in a semiconductor fabrication facility can be increased. The reticle sorters can provide faster response to the associated cell of photolithography steppers and distribute the sorting and, in some instances, inspection functionality of a conventional reticle storage system throughout the fabrication facility. Throughput can further be enhanced by virtue of the physical layout of the reticle sorter within the fabrication facility. For example, reticle sorters may be placed closer to the associated cell than a central reticle storage system thereby reducing the path time of cassettes. The use of relatively inexpensive reticle sorters may also reduce fabrication facility costs by reducing the number of more expensive reticle storage systems needed in the facility.

As noted above, the present invention is applicable to a number of different fabrication plants which may benefit from the use of reticle sorters. The invention also applies to any reticle sorter having functionality as discussed above. Accordingly, the present invention should not be considered limited to the particular examples described above, but rather should be understood to cover all aspects of the invention as fairly set out in the attached claims. Various modifications, equivalent processes, as well as numerous structures to which the present invention may be applicable will be readily apparent to those of skill in the art to which the present invention is directed upon review of the present specification. The claims are intended to cover such modifications and devices.

WE CLAIM:

1. A reticle sorter coupled between a reticle storing system and one or more photolithography exposure tools, comprising:
 - one or more locations each capable of holding a cassette having slots for reticles; and
 - a sorting system capable of retrieving the reticles from and inserting the reticles into the slots in order to sort the reticles within the cassette.
2. The reticle sorter of claim 1, further including a controller coupled to the sorting system for controlling the sorting of the reticles according to a command from a host system.
3. The reticle sorter of claim 1, further including a location for holding a reticle, wherein the sorting system may place a selected reticle on the location during a sorting operation.
4. The reticle sorter of claim 1, wherein the sorting system includes an arm with claws for grasping edges of reticles.
5. The reticle sorter of claim 1, further including an inspection system, coupled between the one or more bays and an input port of the reticle sorter, for inspecting a characteristic of each reticle.
6. The reticle sorter of claim 5, wherein the inspection system includes a video camera coupled to a display device for presenting a visual image of a reticle.
7. The reticle sorter of claim 5, wherein the inspection system includes a tool for measuring an amount of dust on a reticle.

8. The reticle sorter of claim 5, wherein the inspection system includes a tool for detection flaws in a reticle pattern.

9. The reticle sorter of claim 5, further including means for moving each cassettes from the input port to one of the one or more bays.

10. The reticle sorter of claim 1, wherein the sorting system includes two or more docking locations.

11. The reticle sorter of claim 10, wherein the sorting system can move reticles between a first cassette in a first one of the two or more docking locations and a second cassette in a second one of the two or more docking locations.

12. The reticle sorter of claim 1, including three or more bays.

13. A semiconductor fabrication facility, including:
a plurality of photolithography exposure tools;
at least one reticle storage system including a buffer for storing cassettes;
and
one or more reticle sorters each associated with a group of one or more of the exposure tools, each reticle sorter including one or more docking locations each capable of holding a cassette having one or more reticles and sorting system for accessing and sorting reticles within each cassette. --

14. The fabrication facility of claim 13, wherein the facility includes multiple reticle sorters at least one of which is associated with multiple exposure tools.

15. The fabrication facility of claim 13, wherein the one or more reticle sorters each send and receive cassettes to and from the associated group of one or more exposure tools and the reticle storage system.

16. The fabrication facility of claim 15, wherein the reticle storage system buffer includes at least one hundred locations for holding cassettes.

17. A method of sorting cassettes in a semiconductor fabrication facility, comprising;
associating a group of one or more photolithography tools with a reticle sorter;
periodically moving one or more cassettes to the reticle sorter and sorting reticles within the one or more cassettes; and
periodically moving the one or more cassettes to a reticle storage system for storage.

18. The method of 17, further including inspecting, with the reticle sorter, reticles in the one or more cassettes after moving the one or more cassettes to the reticle sorter.

Abstract

A reticle sorter and a semiconductor fabrication facility employing one or more reticle sorters is provided. The reticle sorter(s) generally lies between a reticle storage system and a group of one or more photolithography exposure tools (e.g., steppers) and is configured for sorting reticles in one or more cassettes. The use of the reticle sorter provides sorting functionality apart from the reticle storage system and typically closer to the group of photolithography steppers with which it is associated. This can, for example, significantly increase the throughput of semiconductor wafers through the associated photolithography exposure tools as well as in the semiconductor fabrication plant as a whole.

CERTIFICATE UNDER 37 CFR 1.10:

"Express Mail" mailing label number: E403932016445

Date of Deposit: June 30, 1998

I hereby certify that this paper or fee is being deposited with the U.S. Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to BOX PATENT APPLICATION, Assistant Commissioner for Patents, Washington, D.C. 20231.

By: Mark L. Green

Name: Mark Green

609339-8000000

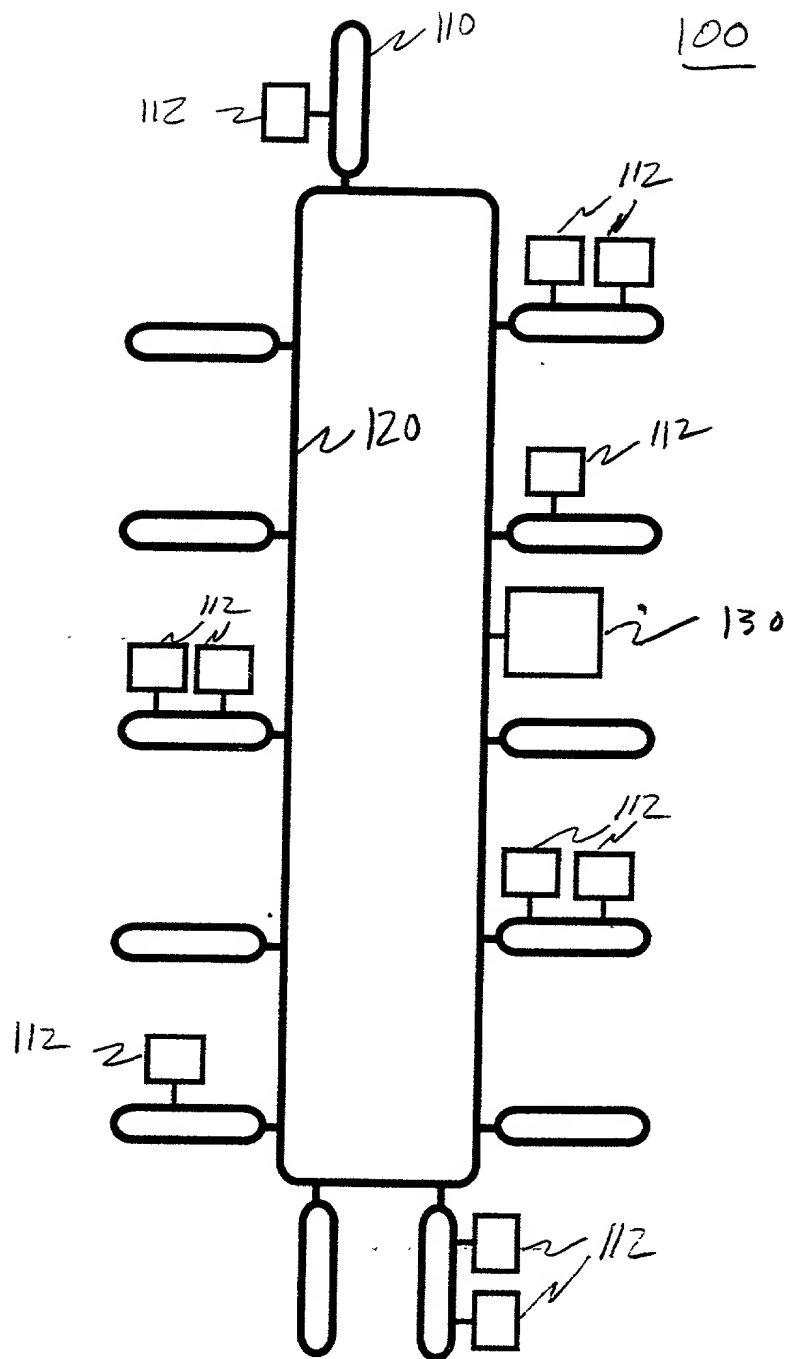


Fig. 1 (Prior Art)

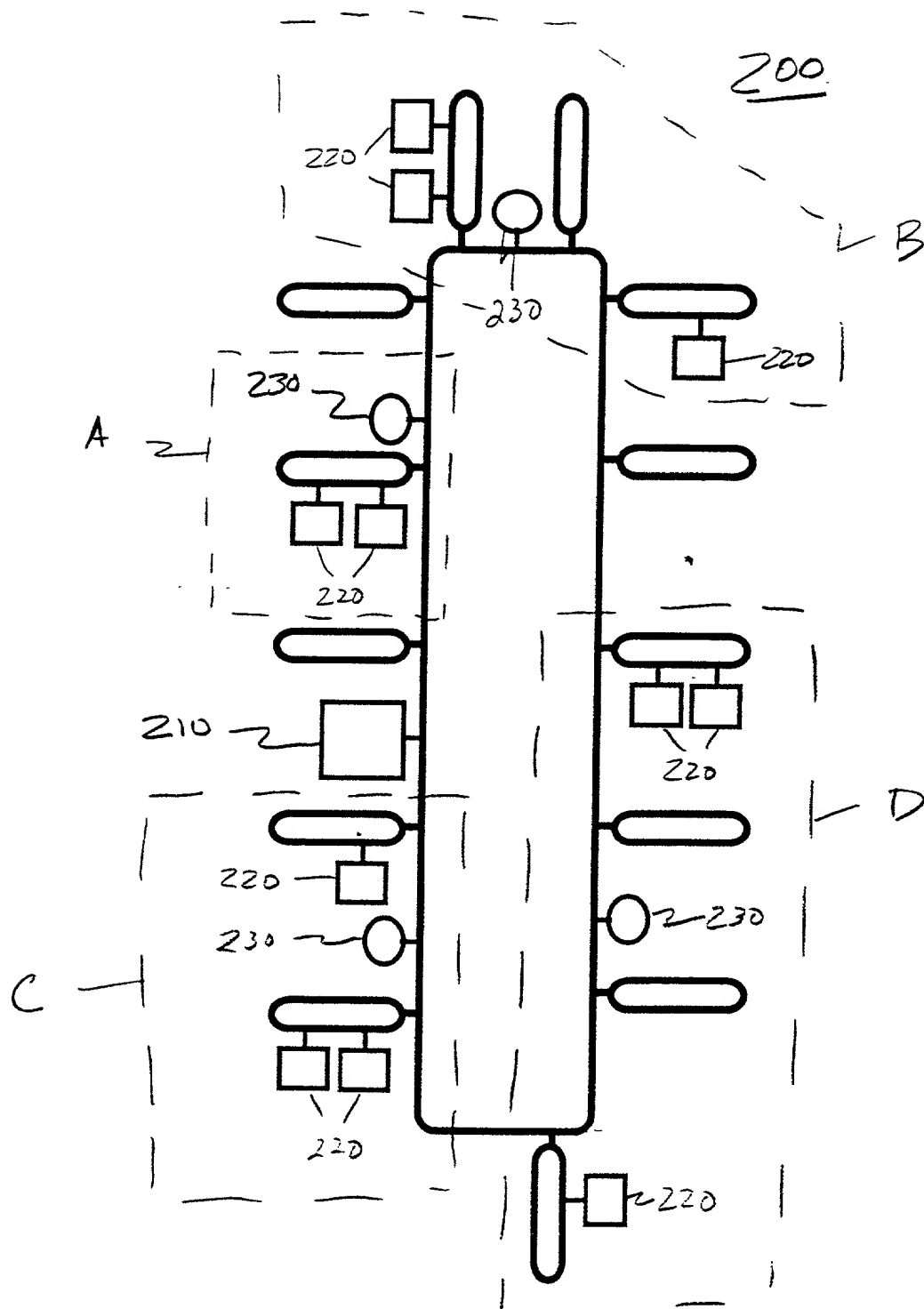


Fig. 2

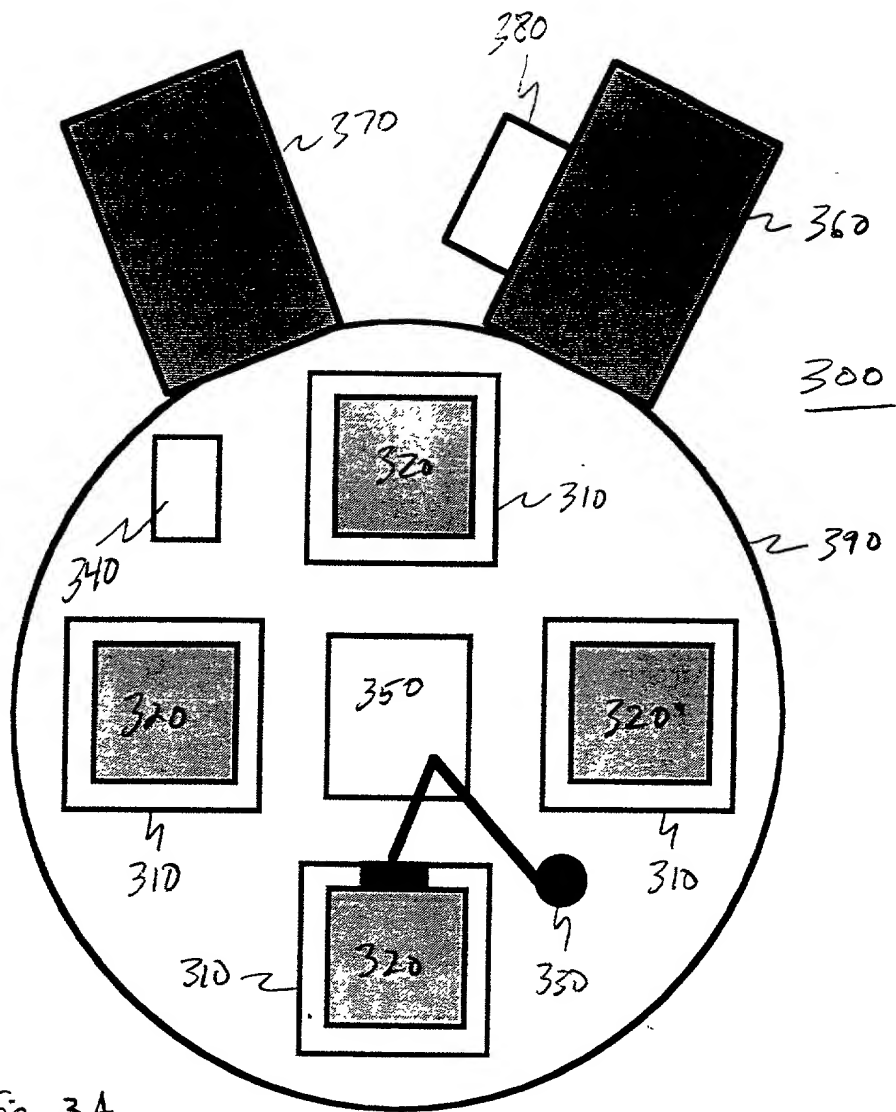


Fig. 3A

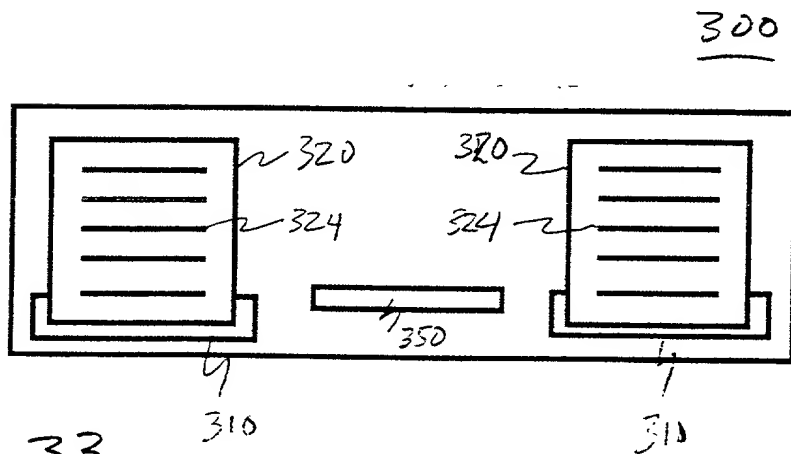


Fig. 3B

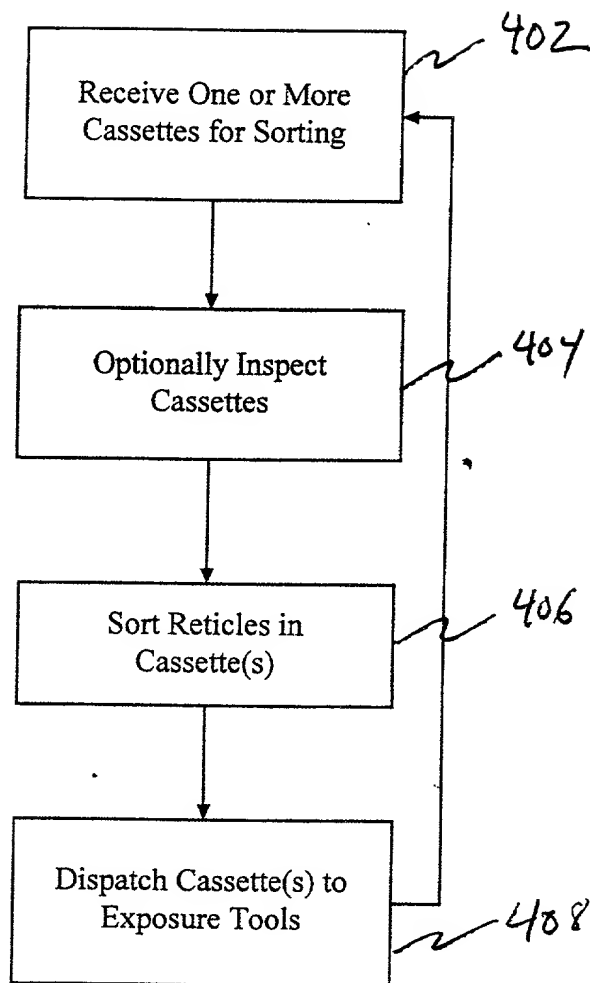


Fig. 4

MERCHANT, GOULD, SMITH, EDELL, WELTER & SCHMIDT

United States Patent Application

COMBINED DECLARATION AND POWER OF ATTORNEY

As a below named inventor I hereby declare that: my residence, post office address and citizenship are as stated below next to my name; that

I verily believe I am the original, first and sole inventor (if only one name is listed below) or a joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: **RETICLE SORTER**

The specification of which

- a. ☐ is attached hereto
- b. ☒ is entitled **RETICLE SORTER**, having an attorney docket number **11729.196US01**.
- c. ☐ was filed on _____ as application serial no. _____ and was amended on _____ (if applicable) (in the case of a PCT-filed application) described and claimed in international no. _____ filed _____ and as amended on _____ (if any), which I have reviewed and for which I solicit a United States patent.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, § 1.56 (attached hereto).

I hereby claim foreign priority benefits under Title 35, United States Code, § 119/365 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on the basis of which priority is claimed:

- a. ☒ no such applications have been filed.
- b. ☐ such applications have been filed as follows:

FOREIGN APPLICATION(S), IF ANY, CLAIMING PRIORITY UNDER 35 USC § 119			
COUNTRY	APPLICATION NUMBER	DATE OF FILING (day, month, year)	DATE OF ISSUE (day, month, year)
ALL FOREIGN APPLICATION(S), IF ANY, FILED BEFORE THE PRIORITY APPLICATION(S)			
COUNTRY	APPLICATION NUMBER	DATE OF FILING (day, month, year)	DATE OF ISSUE (day, month, year)

I hereby claim the benefit under Title 35, United States Code, § 120/365 of any United States and PCT international application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. APPLICATION NUMBER	DATE OF FILING (day, month, year)	STATUS (patented, pending, abandoned)

I hereby claim the benefit under Title 35, United States Code § 119(e) of any United States provisional application(s) listed below:

U.S. PROVISIONAL APPLICATION NUMBER	DATE OF FILING (Day, Month, Year)

I hereby appoint the following attorney(s) and/or patent agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith:

Albrecht, John W.	Reg. No. 40,481	Lacy, Paul E.	Reg. No. 38,946
Batzli, Brian H.	Reg. No. 32,960	Larson, James A.	Reg. No. 40,443
Beard, John L.	Reg. No. 27,612	Lasky, Michael B.	Reg. No. 29,555
Beck, Robert C.	Reg. No. 28,184	Lindquist, Timothy A.	Reg. No. 40,701
Berman, Charles	Reg. No. 29,249	Lynch, David W.	Reg. No. 36,204
Bogucki, Raymond A.	Reg. No. 17,426	Mau, Michael L.	Reg. No. 30,087
Bruess, Steven C.	Reg. No. 34,130	Maunu, Leroy D.	Reg. No. 35,274
Byrne, Linda M.	Reg. No. 32,404	McDaniel, Karen D.	Reg. No. 37,674
Canady, Karen S.	Reg. No. 39,927	McDonald, Daniel W.	Reg. No. 32,044
Carlson, Alan G.	Reg. No. 25,959	McIntyre, Iain A.	Reg. No. 40,377
Carter, Charles G.	Reg. No. 35,093	Mueller, Douglas P.	Reg. No. 30,300
Caspers, Philip P.	Reg. No. 33,227	Nasiedlak, Tyler L.	Reg. No. 40,099
Chiapetta, James R.	Reg. No. 39,634	Nelson, Albin J.	Reg. No. 28,650
Clifford, John A.	Reg. No. 30,247	Orler, Anthony J.	Reg. No. 41,232
Cooper, Victor G.	Reg. No. 39,641	Pauly, Daniel M.	Reg. No. 40,123
Crawford, Robert	Reg. No. 32,122	Plunkett, Theodore	Reg. No. 37,209
Daignault, Ronald A.	Reg. No. 25,968	Pollinger, Steven J.	Reg. No. 35,326
Daley, Dennis R.	Reg. No. 34,994	Pytel, Melissa J.	Reg. No. P-41,512
Dalglish, Leslie E.	Reg. No. 40,579	Reich, John C.	Reg. No. 37,703
Daulton, Julie R.	Reg. No. 36,414	Reiland, Earl D.	Reg. No. 25,767
DiPietro, Mark J.	Reg. No. 28,707	Rittmaster, Ted R.	Reg. No. 32,933
Edell, Robert T.	Reg. No. 20,187	Schmaltz, David G.	Reg. No. 39,828
Epp Ryan, Sandra	Reg. No. 39,667	Schmidt, Cecil C.	Reg. No. 20,566
Farber, Michael B.	Reg. No. 32,612	Schuman, Mark D.	Reg. No. 31,197
Funk, Steven R.	Reg. No. 37,830	Schumann, Michael D.	Reg. No. 30,422
Gates, George H.	Reg. No. 33,500	Sebald, Gregory A.	Reg. No. 33,280
Glance, Robert J.	Reg. No. 40,620	Sharp, Janice A.	Reg. No. 34,051
Golla, Charles E.	Reg. No. 26,896	Skoog, Mark T.	Reg. No. 40,178
Gorman, Alan G.	Reg. No. 38,472	Smith, Jerome R.	Reg. No. 35,684
Gould, John D.	Reg. No. 18,223	Sumner, John P.	Reg. No. 29,114
Gresens, John J.	Reg. No. 33,112	Sumners, John S.	Reg. No. 24,216
Hamre, Curtis B.	Reg. No. 29,165	Tellekson, David K.	Reg. No. 32,314
Hillson, Randall A.	Reg. No. 31,838	Underhill, Albert L.	Reg. No. 27,403
Hollingsworth, Mark A.	Reg. No. 38,491	Vandenburgh, J. Derek	Reg. No. 32,179
Johnston, Scott W.	Reg. No. 39,721	Victor, David W.	Reg. No. 39,867
Kastelic, Joseph M.	Reg. No. 37,160	Welter, Paul A.	Reg. No. 20,890
Kettelberger, Denise	Reg. No. 33,924	Williams, Douglas J.	Reg. No. 27,054
Komanduri, Janaki	Reg. No. 40,684	Wood, Gregory B.	Reg. No. 28,133
Kowalchyk, Alan W.	Reg. No. 31,535	Xu, Min S.	Reg. No. 39,536
Kowalchyk, Katherine M.	Reg. No. 36,848		

Drake, Paul S.	Reg. No. 33,491	Roddy, Richard J.	Reg. No. 27,688
Miller, Louise K.	Reg. No. 36,609	Tortolano, J. Vincent	Reg. No. 31,433
Pitruzella, Vincenzo D.	Reg. No. 28,656	Wisor, Rita M.	Reg. No. 41,382
Quarton, Charles E.	Reg. No. 24,825	Zahrt II, William D.	Reg. No. 26,070
Riley, Louis A.	Reg. No. 39,817	Apperley, Elizabeth A.	Reg. No. 36,428

I hereby authorize them to act and rely on instructions from and communicate directly with the person/assignee/attorney/firm/organization who/which first sends/sent this case to them and by whom/which I hereby declare that I have consented after full disclosure to be represented unless/until I instruct Merchant, Gould, Smith, Edell, Welter & Schmidt to the contrary.

Please direct all correspondence in this case to Merchant, Gould, Smith, Edell, Welter & Schmidt at the address indicated below:

Merchant, Gould, Smith, Edell,
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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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§ 1.56 Duty to disclose information material to patentability.

(a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual

to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is canceled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is canceled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§ 1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

(1) prior art cited in search reports of a foreign patent office in a counterpart application, and

(2) the closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.

(b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made of record in the application, and

(1) It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a claim;

or

(2) It refutes, or is inconsistent with, a position the applicant takes in:

(i) Opposing an argument of unpatentability relied on by the Office, or

(ii) Asserting an argument of patentability.

A prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

(c) Individuals associated with the filing or prosecution of a patent application within the meaning of this section are:

(1) Each inventor named in the application;

(2) Each attorney or agent who prepares or prosecutes the application; and

(3) Every other person who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.

(d) Individuals other than the attorney, agent or inventor may comply with this section by disclosing information to the attorney, agent, or inventor.